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Hara et al.

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(54) **IMAGE FORMING APPARATUS**

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(51) **Int. Cl.**

G03G 15/36	(2006.01)
G03G 15/16	(2006.01)
G03G 15/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G03G 15/5025*** (2013.01); ***G03G 15/16*** (2013.01)

(58) **Field of Classification Search**

CPC G03G 15/5025; G03G 15/5029; G03G 15/16

USPC 399/45

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,493,386	A *	2/1996	Thompson	G03G 15/01 382/181
6,434,346	B1 *	8/2002	Knott	G03G 15/0855 399/27
2003/0059697	A1 *	3/2003	Dontula	B32B 27/08 430/104
2004/0252342	A1 *	12/2004	Kawahira	G03G 15/047 358/1.18

FOREIGN PATENT DOCUMENTS

JP 2006-317632 A 11/2006

* cited by examiner

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(57) **ABSTRACT**

An image forming apparatus includes a forming unit that forms a toner image with a substantially flat toner containing a substantially flat metal pigment on a movable body; a transfer unit that forms a nip with the movable body and transfers the toner image on a medium transported to the nip; and a controller that, if at least one of first and second conditions, the first condition in which an image width from data for allowing the forming unit to form the toner image is larger than a predetermined width, the second condition in which an area coverage from the data is higher than a predetermined area coverage, is satisfied, causes the forming unit to form a toner image with a corrected area coverage lower than the area coverage from the data.

6 Claims, 14 Drawing Sheets

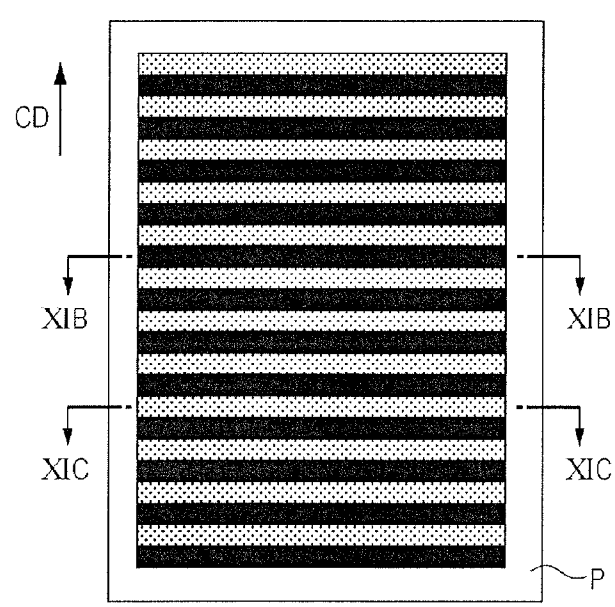

FIG. 1

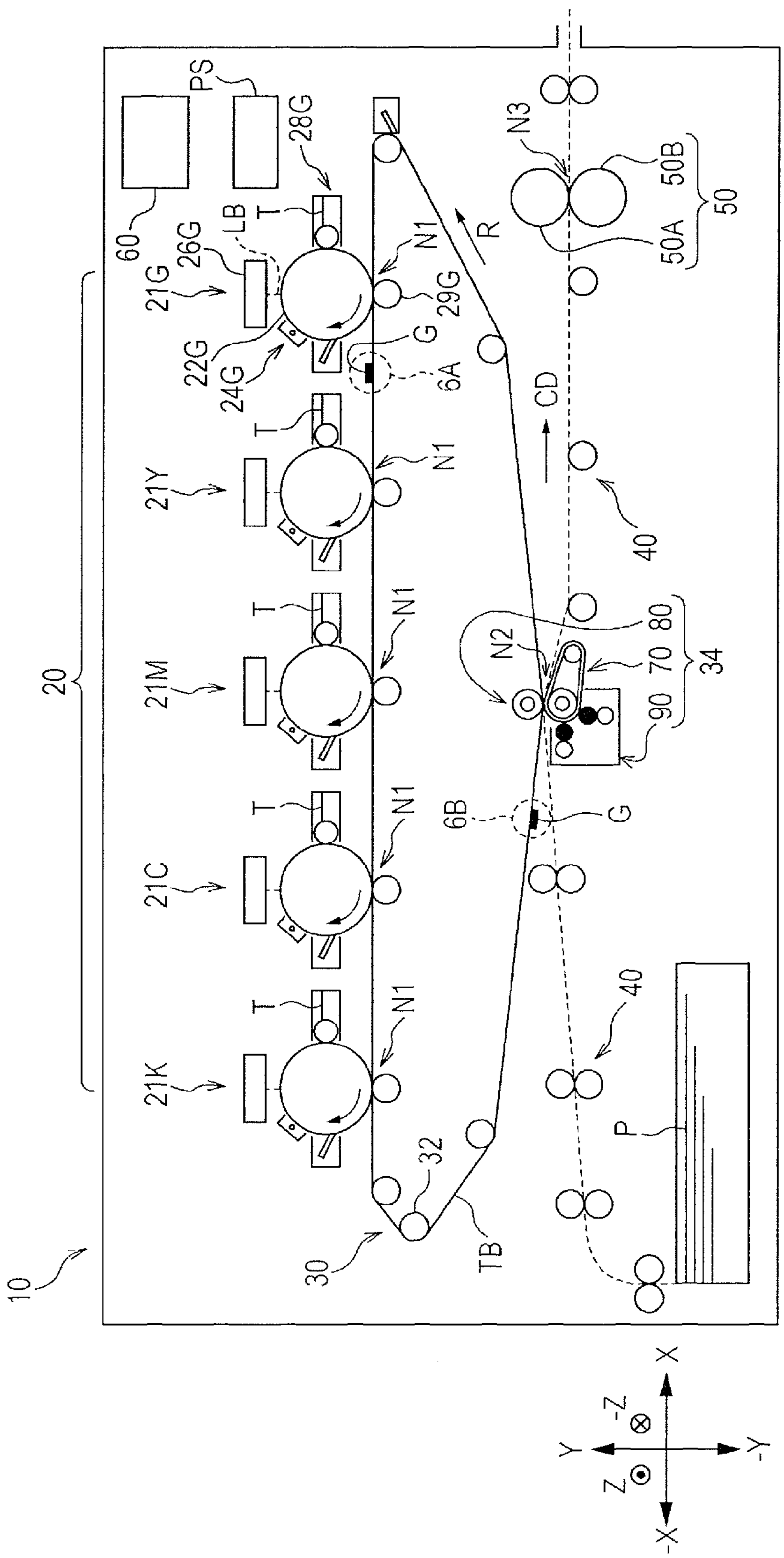
10
20
21K
21C
21M
21Y
21G
22G
24G
26G
28G
29G
LB
T
N1
N2
N3
G
6A
6B
60
PS
R
CD
40
30
32
TB
P
70
80
90
34
50
50A
50B
X
-X
Y
-Y
Z
-Z

FIG. 2

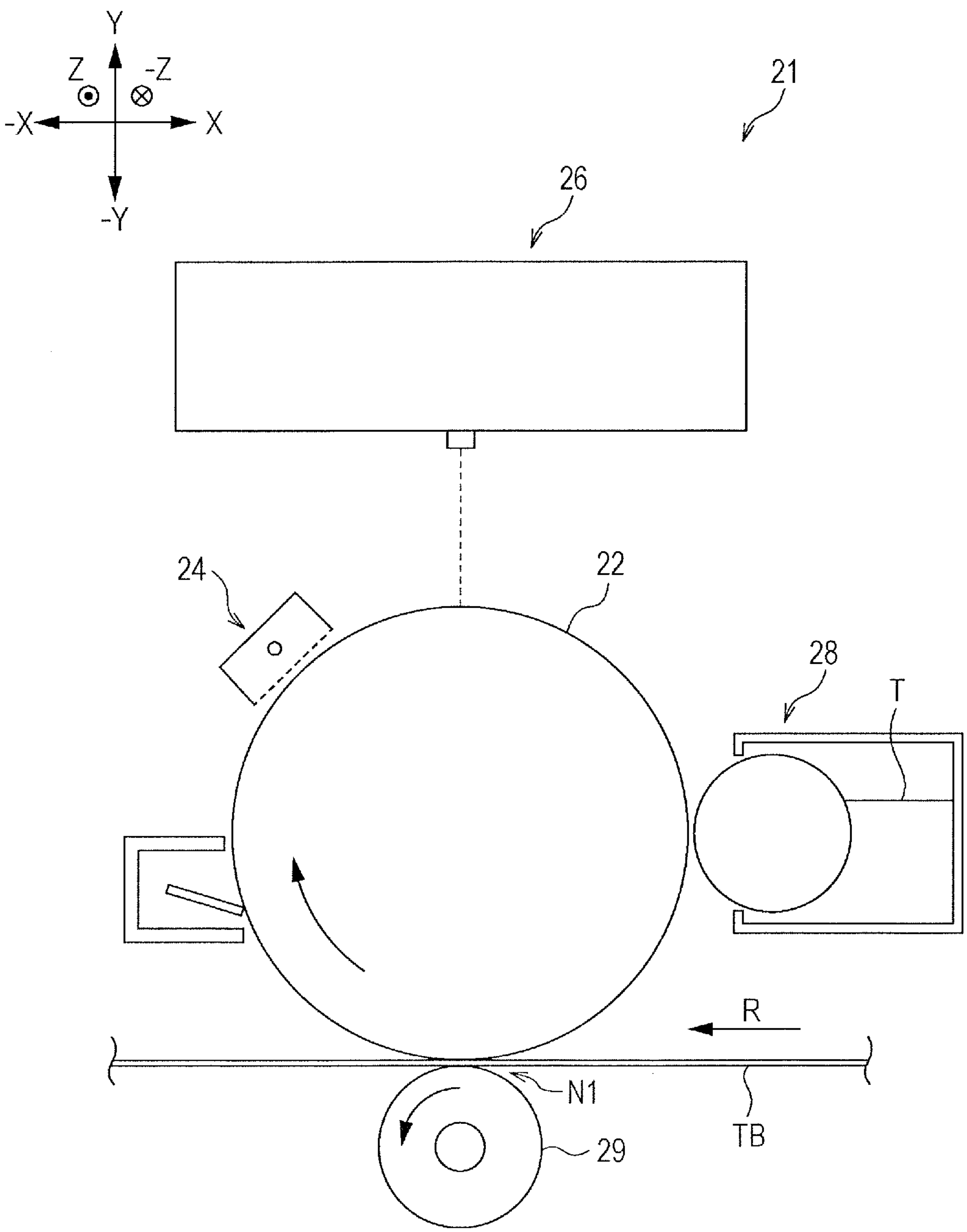

FIG. 3

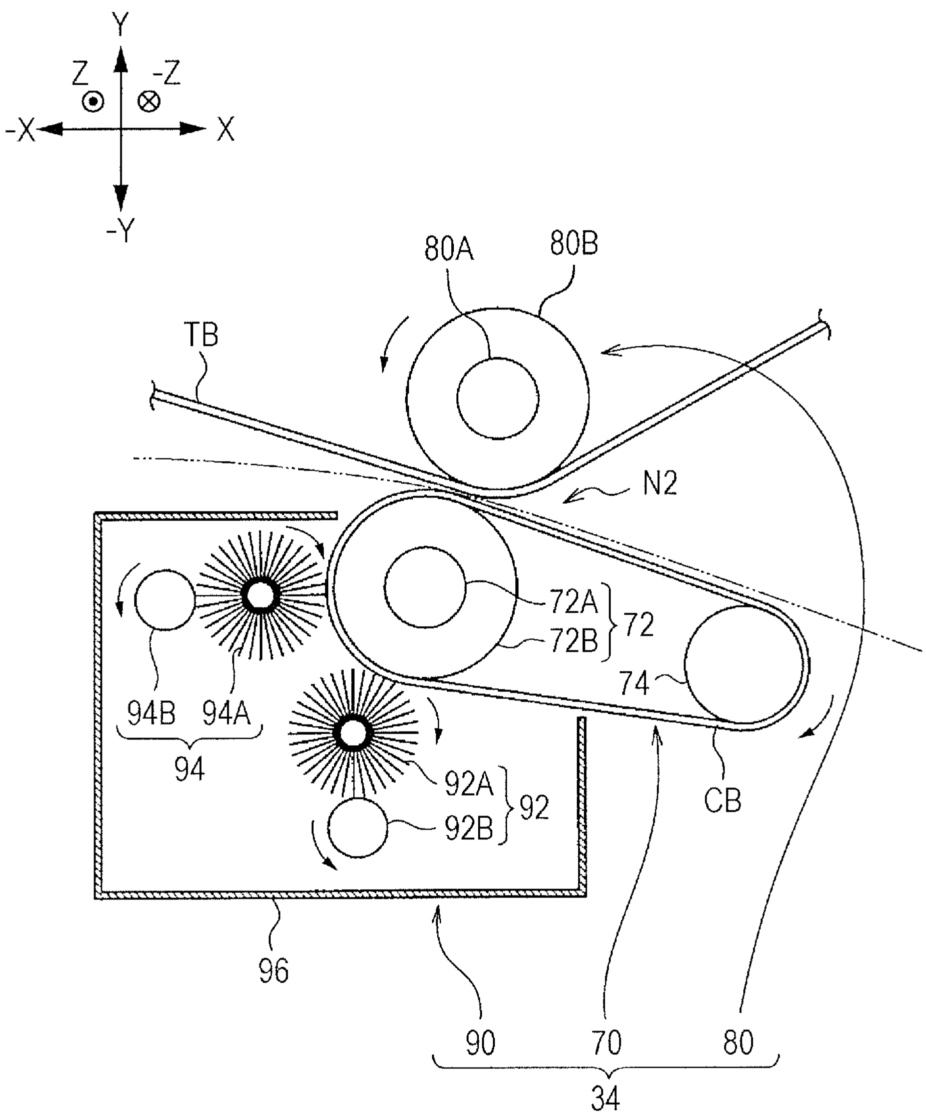
Y
Z
-Z
-X
X
-Y
80A
80B
TB
N2
72A
72B
72
74
CB
94B
94A
94
92A
92B
92
96
90
70
80
34

FIG. 4

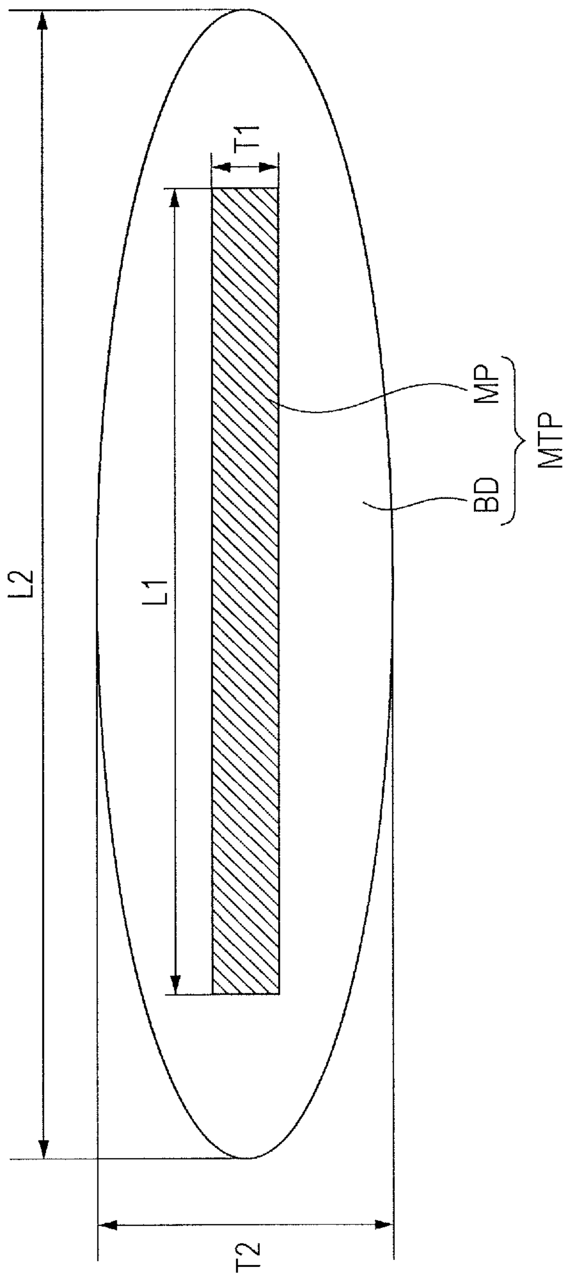

FIG. 5

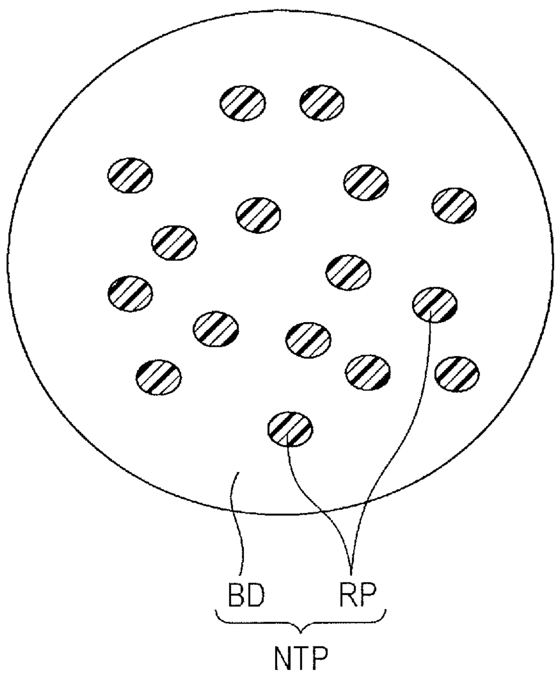

FIG. 6A

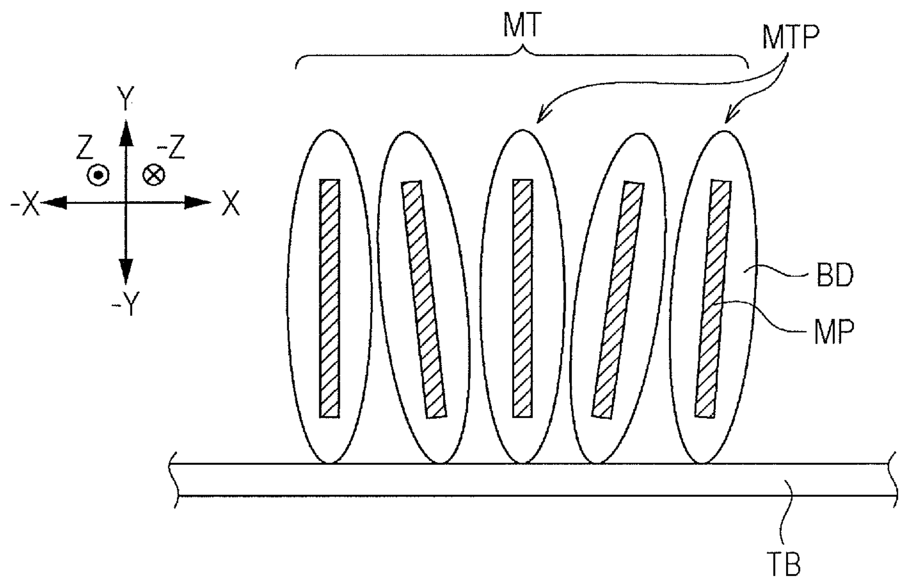

FIG. 6B

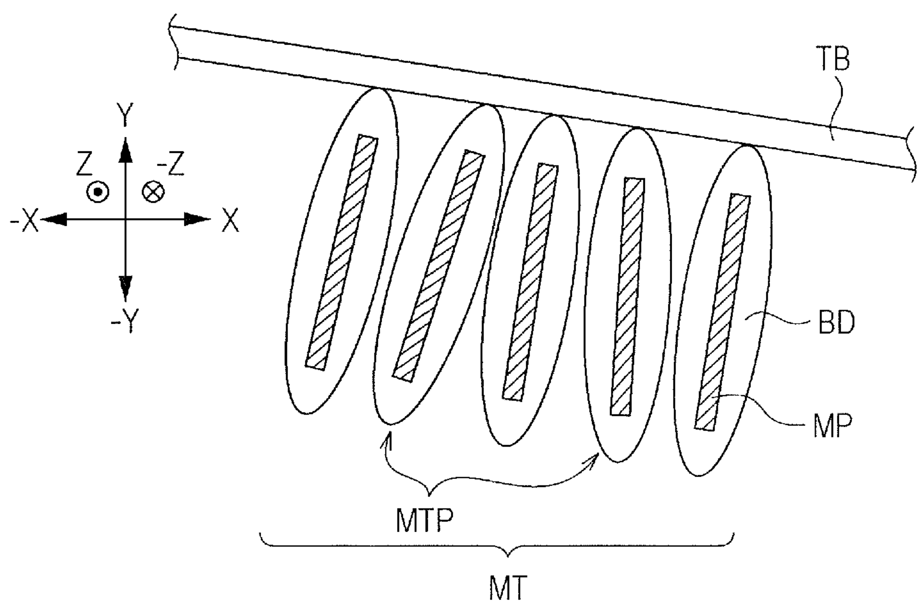

FIG. 7

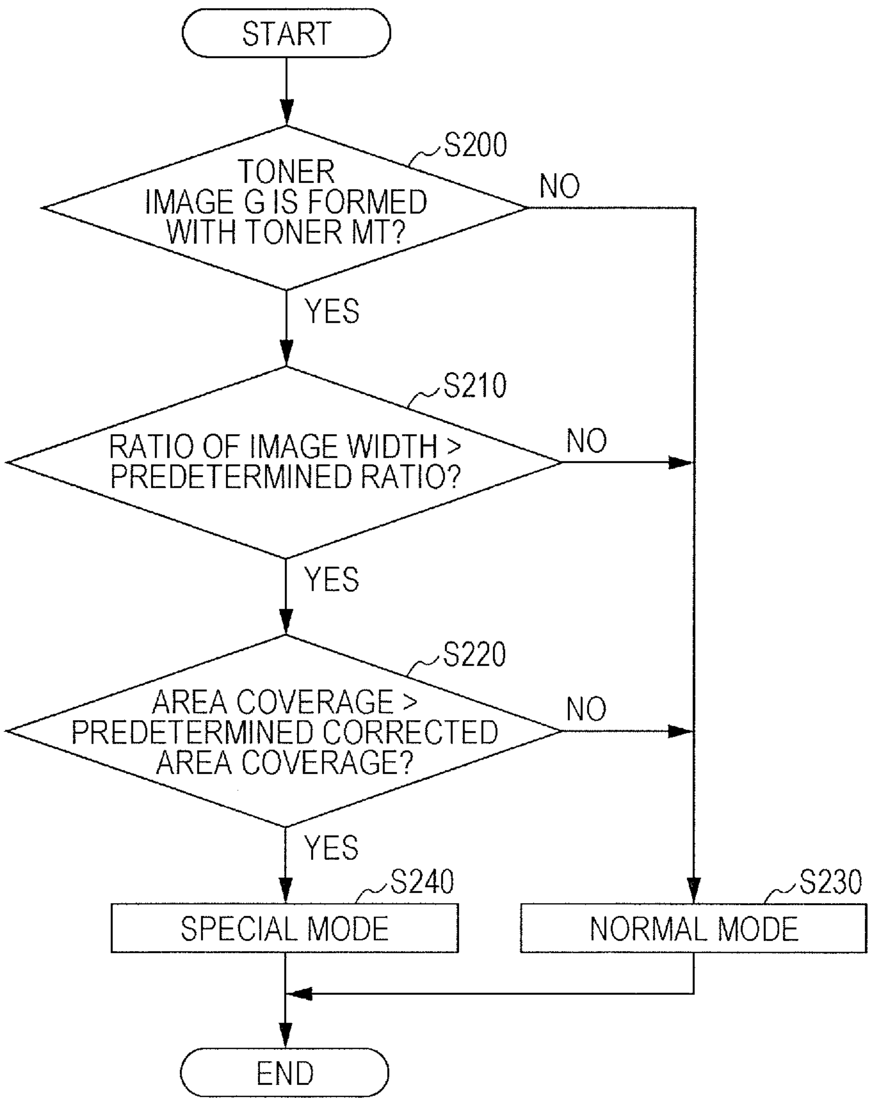
START
S200
TONER IMAGE G IS FORMED WITH TONER MT?
NO
YES
S210
RATIO OF IMAGE WIDTH > PREDETERMINED RATIO?
NO
YES
S220
AREA COVERAGE > PREDETERMINED CORRECTED AREA COVERAGE?
NO
YES
S240
SPECIAL MODE
S230
NORMAL MODE
END

FIG. 8

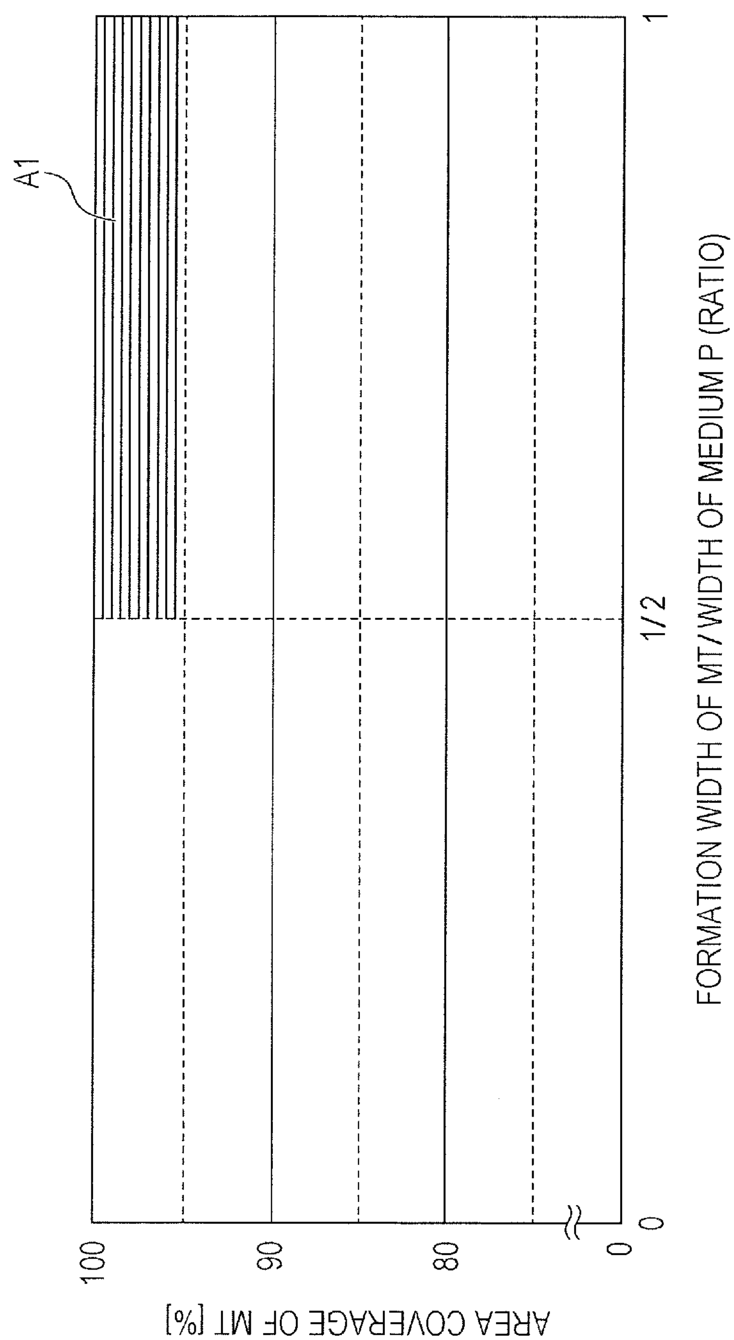
A1
100
90
80
0
0
1/2
1
AREA COVERAGE OF MT [%]
FORMATION WIDTH OF MT / WIDTH OF MEDIUM P (RATIO)

FIG. 9

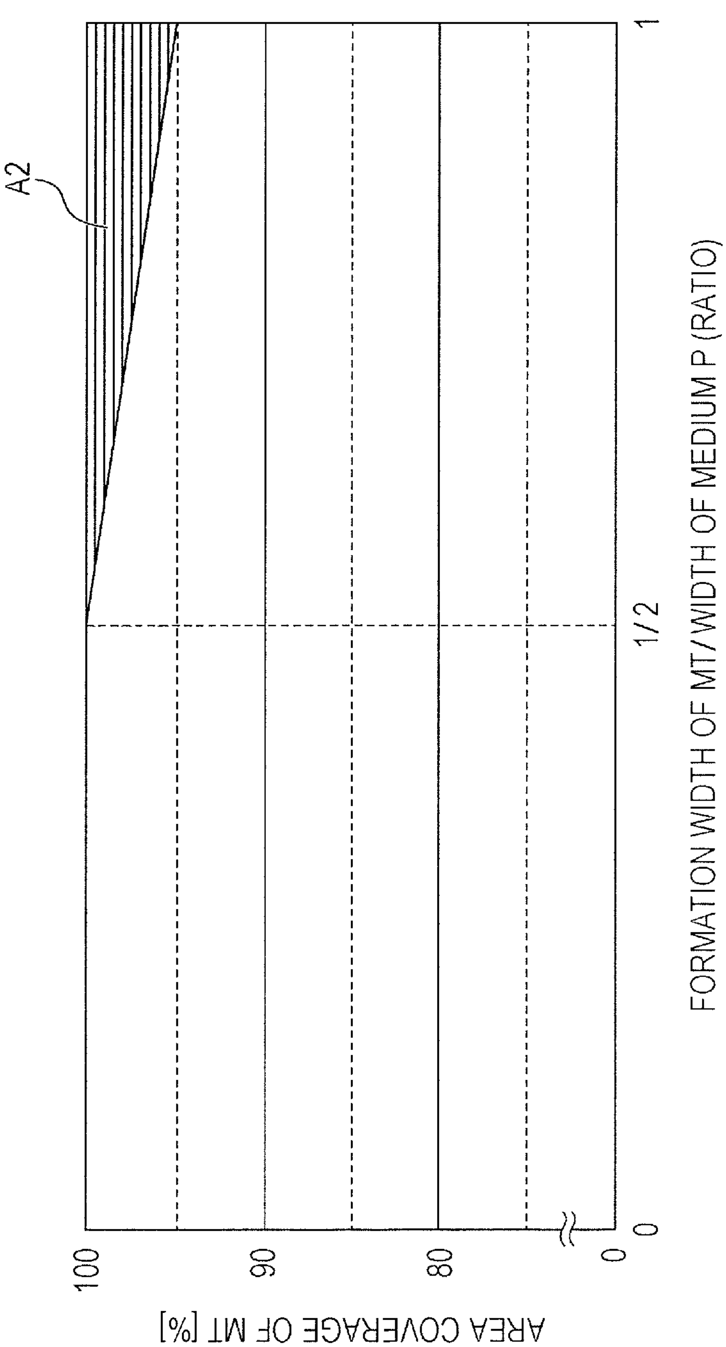
A2
100
90
80
0
0
1/2
1
FORMATION WIDTH OF MT/WIDTH OF MEDIUM P (RATIO)
AREA COVERAGE OF MT [%]

FIG. 10

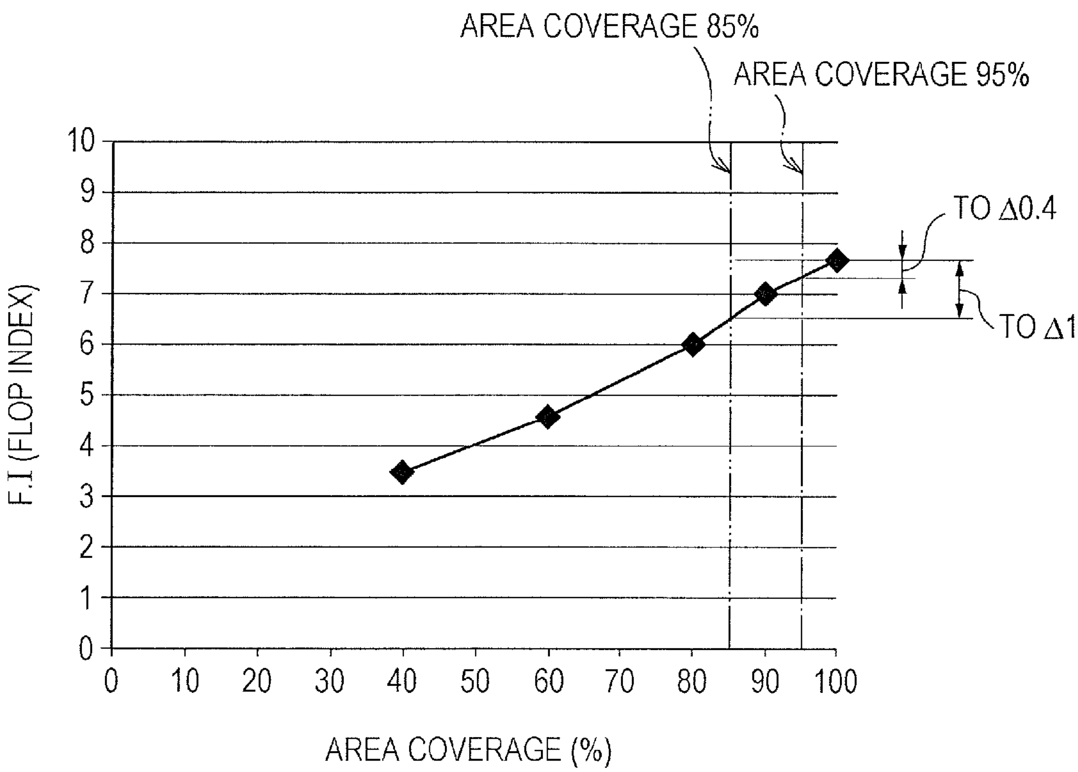
AREA COVERAGE 85%
AREA COVERAGE 95%
TO Δ0.4
TO Δ1
F.I (FLOP INDEX)
AREA COVERAGE (%)
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60
70
80
90
100

FIG. 11A

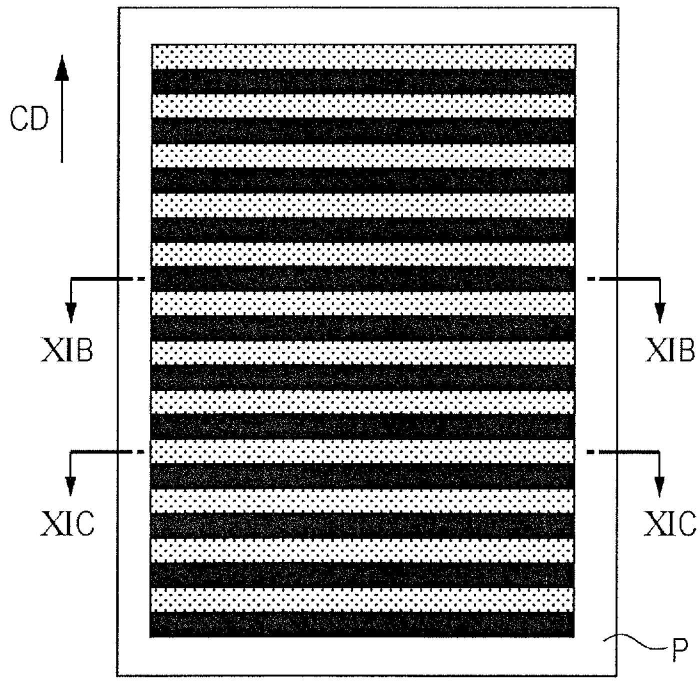

FIG. 11B

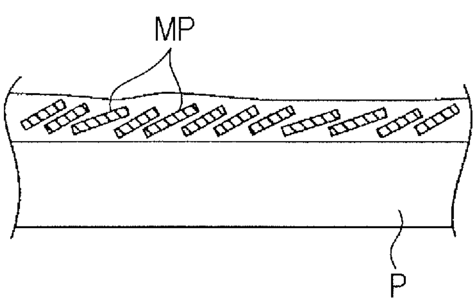

FIG. 11C

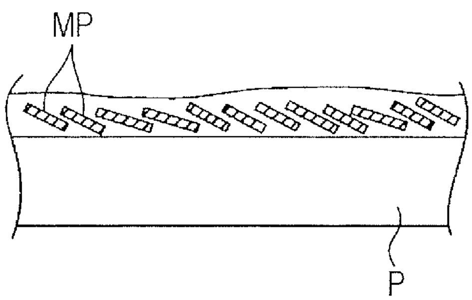

FIG. 12

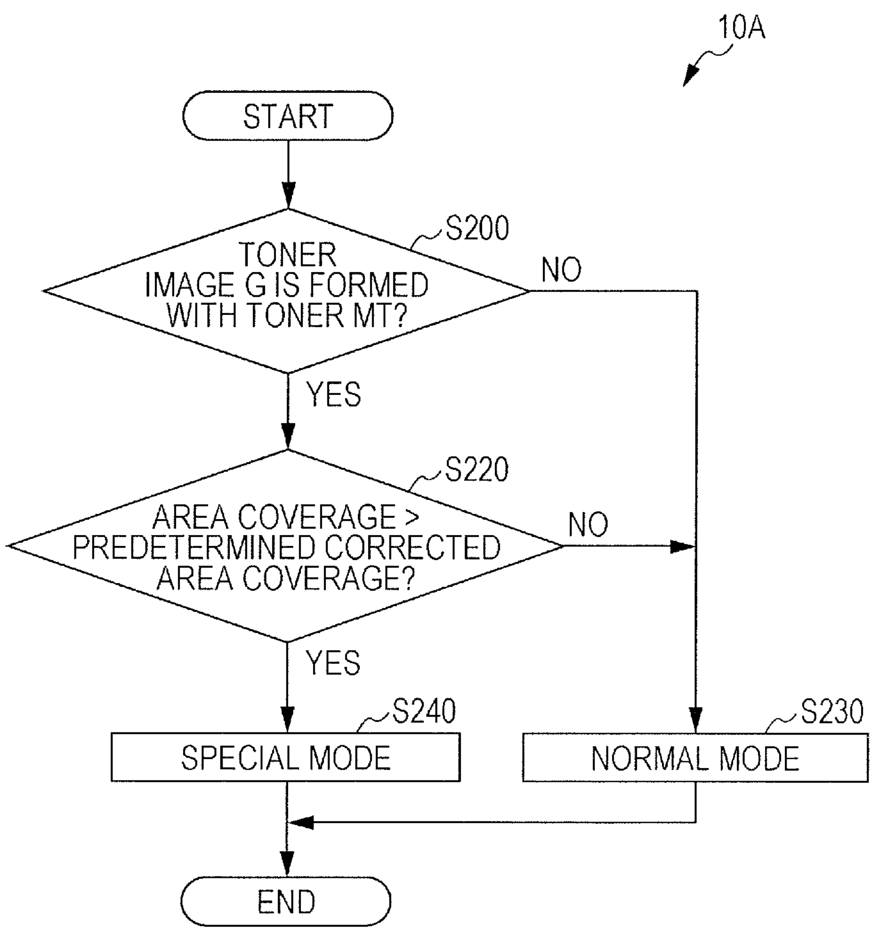
10A
START
TONER
IMAGE G IS FORMED
WITH TONER MT?
S200
NO
YES
AREA COVERAGE >
PREDETERMINED CORRECTED
AREA COVERAGE?
S220
NO
YES
SPECIAL MODE
S240
NORMAL MODE
S230
END

FIG. 13

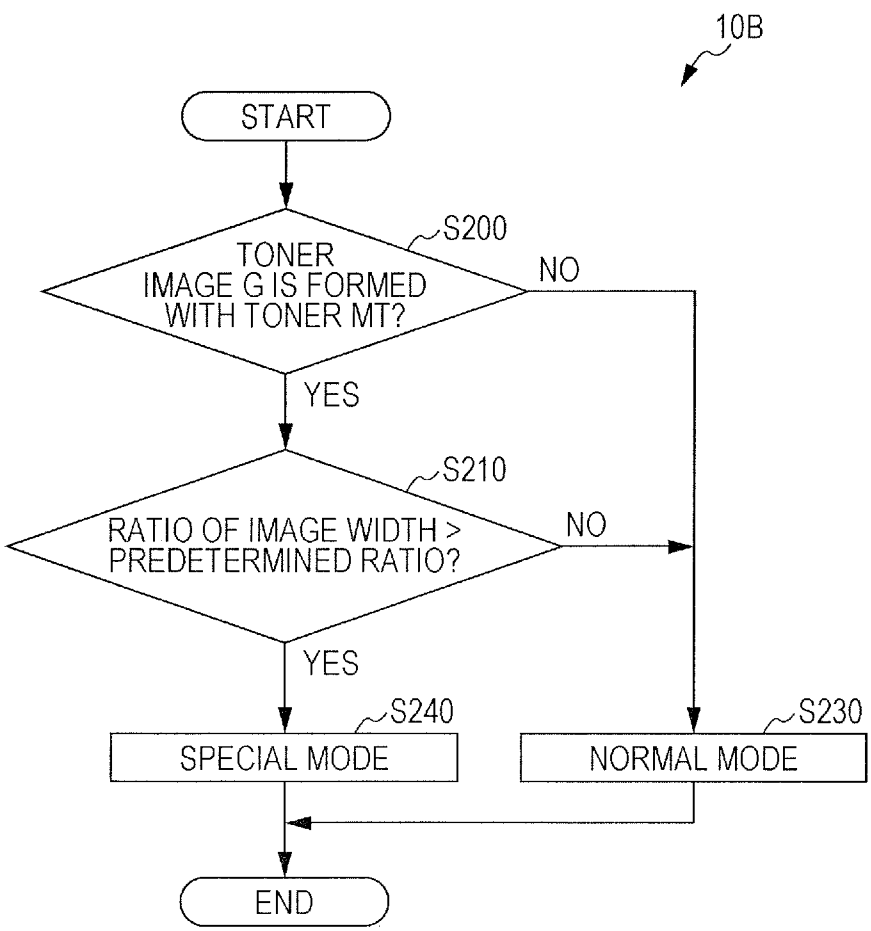
10B
START
S200
TONER IMAGE G IS FORMED WITH TONER MT?
NO
YES
S210
RATIO OF IMAGE WIDTH > PREDETERMINED RATIO?
NO
YES
S240
SPECIAL MODE
S230
NORMAL MODE
END

FIG. 14

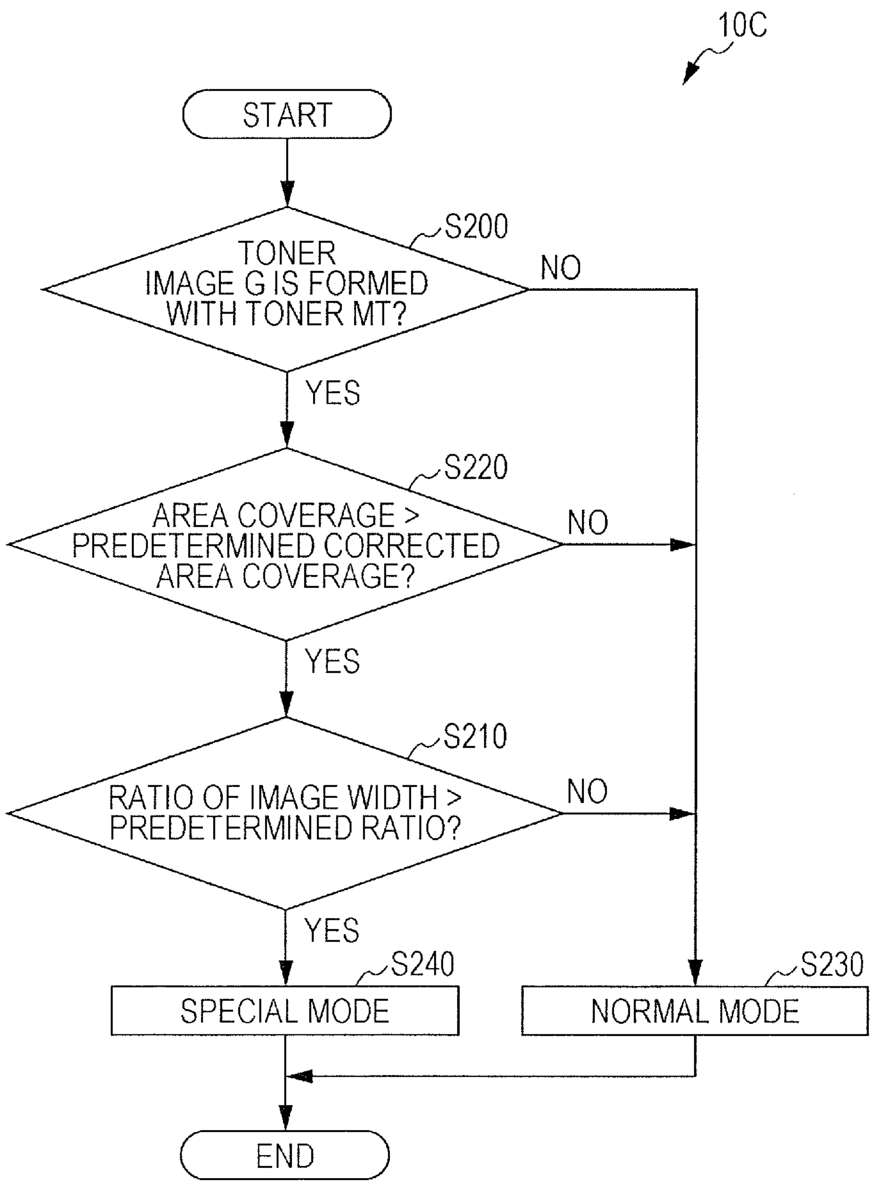
10C
START
S200
TONER IMAGE G IS FORMED WITH TONER MT?
NO
YES
S220
AREA COVERAGE > PREDETERMINED CORRECTED AREA COVERAGE?
NO
YES
S210
RATIO OF IMAGE WIDTH > PREDETERMINED RATIO?
NO
YES
S240
SPECIAL MODE
S230
NORMAL MODE
END

IMAGE FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2015-031996 filed Feb. 20, 2015.

BACKGROUND

The present invention relates to an image forming apparatus.

SUMMARY

According to an aspect of the invention, there is provided an image forming apparatus including a forming unit that forms a toner image with a substantially flat toner containing a substantially flat metal pigment on a movable body; a transfer unit that forms a nip with the movable body and transfers the toner image on a medium transported to the nip; and a controller that, if at least one of first and second conditions, the first condition in which an image width from data for allowing the forming unit to form the toner image is larger than a predetermined width, the second condition in which an area coverage from the data is higher than a predetermined area coverage, is satisfied, causes the forming unit to form a toner image with a corrected area coverage lower than the area coverage from the data.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the present invention will be described in detail based on the following figures, wherein:

FIG. **1** is schematic view (front view) of an image forming apparatus according to a first exemplary embodiment;

FIG. **2** is a schematic view (front view) of a toner image forming unit configuring the image forming apparatus according to the first exemplary embodiment;

FIG. **3** is a schematic view of a peripheral area of a second transfer unit of a transfer device configuring the image forming apparatus according to the first exemplary embodiment;

FIG. **4** is a schematic view (cross-sectional view) of a toner particle of a flat toner that is used by the image forming apparatus according to the first exemplary embodiment;

FIG. **5** is a schematic view (cross-sectional view) of a toner particle of a non-flat toner that is used by the image forming apparatus according to the first exemplary embodiment;

FIGS. **6**A and **6**B are each an illustration showing a flat toner held on a transfer belt of the image forming apparatus according to the first exemplary embodiment, FIG. **6**A being a schematic view showing a flat toner configuring a toner image within a dotted-line area **6**A in FIG. **1**, FIG. **6**B being a schematic view showing a flat toner configuring a toner image within a dotted-line area **6**B in FIG. **1**;

FIG. **7** is a flowchart of control that is executed during an operation of image formation by a controller configuring the image forming apparatus according to the first exemplary embodiment;

FIG. **8** is a schematic view showing a predetermined condition of the controller in the flowchart in FIG. **7**, in the image forming apparatus according to the first exemplary embodiment;

FIG. **9** is a graph showing a test result that serves as the basis of the predetermined condition in FIG. **8**;

FIG. **10** is a graph showing a test result that serves as the basis of the predetermined condition in FIG. **8**;

FIG. **11**A is a schematic view showing an image on a medium formed by an image forming apparatus according to a comparative exemplary embodiment, FIG. **11**B is a partial cross-sectional view taken along line XIB-XIB in FIG. **11**A, and FIG. **11**C is a partial cross-sectional view taken along line XIC-XIC in FIG. **11**A;

FIG. **12** is a flowchart of control that is executed during an operation of image formation by a controller configuring an image forming apparatus according to another exemplary embodiment;

FIG. **13** is a flowchart of control that is executed during an operation of image formation by a controller configuring an image forming apparatus according to still another exemplary embodiment; and

FIG. **14** is a flowchart of control that is executed during an operation of image formation by a controller configuring an image forming apparatus according to yet another exemplary embodiment.

DETAILED DESCRIPTION

Overview

An exemplary embodiment for implementing the invention (hereinafter, referred to as exemplary embodiment) is described below. First, a configuration of an image forming apparatus **10** (see FIG. **1**) of this exemplary embodiment and a toner (see FIGS. **4** and **5**) that is used by the image forming apparatus **10** are described. Then, an image forming operation of the image forming apparatus **10** of this exemplary embodiment is described. Then, effects of this exemplary embodiment are described.

In the following description, directions indicated by arrow X and arrow −X in the drawings represent an apparatus width direction, and directions indicated by arrow Y and arrow −Y in the drawings represent an apparatus height direction. Also, directions (arrow Z and arrow −Z directions) orthogonal to the apparatus width direction and the apparatus height direction represent an apparatus depth direction.

Configuration of Image Forming Apparatus

As shown in FIG. **1**, the image forming apparatus **10** is an apparatus using an electrophotographic system including a toner image forming unit **20**, a transfer device **30**, a transport device **40**, a fixing device **50**, a controller **60**, and a power supply PS.

Toner Image Forming Unit

The toner image forming unit **20** has a function of forming a toner image G (see FIGS. **1** and **6**) on a transfer belt TB (described later), which configures the transfer device **30**, by executing respective processes of electric charge, exposure, and development.

The toner image forming unit **20** includes single-color units **21**G, **21**Y, **21**M, **21**C, and **21**K that form toner images G of different colors (G (gold), Y (yellow), M (magenta), C (cyan), K (black)). The single-color units **21**G, **21**Y, **21**M, **21**C, and **21**K have similar configurations except the colors of the respectively formed toner images G. Hereinafter, in the specification and drawings, the alphabets (G, Y, M, C, K) of the single-color units **21**G, **21**Y, **21**M, **21**C, and **21**K are omitted unless otherwise the single-color units **21**G, **21**Y, **21**M, **21**C, and **21**K and their components are required to be distinguished from one another.

The single-color unit **21**G forms a toner image G with a flat or substantially flat toner MT (hereinafter, referred to as toner MT, see FIG. **4**), which is described later, on the transfer belt TB. The single-color unit **21**G is an example of a forming unit. The single-color units **21** other than the single-color unit **21**G each form a toner image G with a non-flat toner NT (hereinafter, referred to as toner NT, see FIG. **5**), which is described later, on the transfer belt TB. The toner MT and the toner NT of this exemplary embodiment each have, for example, negative polarity (average of charge amount distribution is negative). In the following description, the toners MT and NT are described as a toner T unless otherwise the toner MT and the toner NT are particularly required to be distinguished from one another.

As shown in FIGS. **1** and **2**, each single-color unit **21** includes a cylindrical photoconductor **22**, a charging device **24**, an exposure device **26**, a developing device **28**, and a first transfer roller **29**. The charging device **24** electrically charges the photoconductor **22**, the exposure device **26** exposes the photoconductor **22** to light, the developing device **28** develops a toner image G, and the first transfer roller **29** first transfers the toner image G on the moving (circulating) transfer belt TB at a nip N**1**. Thus, the toner image forming unit **20** forms toner images G on the transfer belt TB. A first transfer voltage (voltage with positive polarity) is applied from the power supply PS to each first transfer roller **29**, and hence the first transfer roller **29** first transfers a corresponding toner image G formed on the corresponding photoconductor **22**, on the moving transfer belt TB at the corresponding nip N**1**. The exposure device **26** forms, for example, a latent image on the photoconductor **22** with an exposure dot corresponding to 1200 dpi×1200 dpi (about 21 μm×about 21 μm). In FIG. **1**, the reference signs for the components of the single-color units **21** other than the single-color unit **21**K are omitted.

Transfer Device

The transfer device **30** has a function of second transferring the toner images G of the respective colors formed by the respective single-color units **21** and first transferred at the nips N1, on a medium P transported to a nip N2 (described later). As shown in FIG. **1**, the transfer device **30** includes the transfer belt TB, a driving roller **32**, and a second transfer unit **34**.

Transfer Belt and Driving Roller

The transfer belt TB is endless. The driving roller **32** is driven by a driving source (not shown), and moves the transfer belt TB in arrow R direction while rotating around its axis. The toner belt TB causes the toner images G of the respective colors formed by the respective single-color units **21** to reach the nip N2 while holding the toner images G of the respective colors on the outer periphery. The transfer belt TB is an example of a movable body.

Second Transfer Unit

The second transfer unit **34** has a function of second transferring the toner images G of the respective colors held on the transfer belt TB, on a medium P transported by the transport device **40** to the nip N2. As shown in FIGS. **1** and **3**, the second transfer unit **34** includes a second transfer portion **70**, a backup roller **80** (hereinafter, referred to as BUR **80**), and a removing unit **90**.

Second Transfer Unit and BUR

The second transfer portion **70** includes a conductive roller **72**, a tension roller **74**, and a conductive belt CB.

The conductive belt CB has a function of forming the nip N**2** with the transfer belt TB while the conductive belt CB circulates, and transferring a toner image G on a medium P transported to the nip N**2**. The conductive belt CB is an example of a transfer unit. The conductive roller **72** includes a shaft **72**A, and a cylindrical conductive layer **72**B. The conductive roller **72** is driven by a driving source (not shown) and rotates around its axis. The conductive belt CB is endless, and is wound around the cylindrical conductive layer **72**B. The tension roller **74** presses the conductive belt CB from the inner periphery side, and gives a tension to the conductive belt CB. With the above-described configuration, in the second transfer portion **70**, the conductive belt CB circulates while the conductive roller **72** rotates around its axis. The shaft **72**A of the conductive roller **72** is grounded.

As shown in FIGS. **1** and **3**, the BUR **80** is arranged at the side opposite to the second transfer portion **70** (upper side) with the transfer belt TB interposed therebetween, and causes the conductive belt CB and the transfer belt TB to form the nip N2. The BUR **80** includes a shaft **80**A, and a cylindrical conductive layer **80**B. A voltage is applied from the power supply PS (see FIG. **1**) to the shaft **80**A of the BUR **80**. To be specific, when a medium P passes through the nip N2, a second transfer voltage (voltage with negative polarity) is applied from the power supply PS to the BUR **80**. Accordingly, the conductive belt CB forms an electric field that causes a toner image G to be second transferred on the medium P. Also, before and after the medium P passes through the nip N2, a voltage with positive polarity is applied from the power supply PS to the BUR **80**. Accordingly, the conductive belt CB forms an electric field that causes the transfer belt TB to hold a fog toner, which is toner adhered to non-image areas where toner should not adhere at the nip N2, etc. at the nip N2.

Removing Unit

The removing unit **90** has a function of removing a toner T (the aforementioned fog toner etc.) adhering to the conductive belt CB. As shown in FIG. **3**, the removing unit **90** includes a first removing portion **92**, a second removing portion **94**, and a housing **96**. The first removing portion **92** and the second removing portion **94** are arranged in the housing **96**.

The first removing portion **92** has a function of removing a toner T electrically charged with negative polarity. The first removing portion **92** includes a conductive brush **92**A and a metal shaft **92**B. The conductive brush **92**A contacts (bites into) the conductive belt CB. The metal shaft **92**B contacts the conductive brush **92**A. The second removing portion **94** has a function of removing a toner T electrically charged with positive polarity. The second removing portion **94** is arranged at a part located downstream of the first removing portion **92** and located upstream of the nip N2 in a circulation direction of the conductive belt CB. The second removing portion **94** includes a conductive brush **94**A and a metal shaft **94**B. The conductive brush **94**A contacts the conductive belt CB.

When the metal shaft **94**B is driven by a driving source (not shown), the metal shaft **94**B rotates counterclockwise in a view from the near side in the apparatus depth direction. Also, a torque is transmitted to the conductive brushes **92**A and **94**A, and the metal shaft **92**B through a gear (not shown) meshing with a gear (not shown) provided at the metal shaft **94**B. Consequently, the metal shaft **92**B rotates counterclockwise, and the conductive brushes **92**A and **94**A rotate clockwise. As described above, in this exemplary embodiment, the conductive brushes **92**A and **94**A, and the metal shaft **92**B are rotated when the metal shaft **94**B rotates, and are stopped when the metal shaft **94**B stops. In the image forming apparatus **10** of this exemplary embodiment, the metal shaft **94**B rotates around its axis during a period of an image forming operation. Also, since a voltage with positive polarity is applied to the metal shaft **92**B and a voltage with negative polarity is applied to the metal shaft **94**B from the power supply PS, the first removing portion **92** and the second removing portion **94** respectively remove a toner T with negative polarity and a toner T with positive polarity.

Transport Device

The transport device **40** has a function of transporting a medium P. The transport device **40** transports a medium P in a transport direction CD (see FIG. **1**).

Fixing Device

The fixing device **50** has a function of applying heat and pressure at a nip N**3** to the toners T forming the toner images G of the respective colors second transferred on the medium P by the transfer device **30**, and hence fixing the toners T to the medium P. The fixing device **50** includes a heating portion **50**A and a pressing portion **50**B.

Controller

The controller **60** has a function of controlling respective units other than the controller **60** configuring the image forming apparatus **10** (hereinafter, referred to as respective units other than the controller **60**).

The controller **60** receives job data from an external device (not shown). The job data is an example of data. The controller **60** which has received the job data controls the respective units other than the controller **60** configuring the image forming apparatus **10** by following, for example, a flowchart in FIG. **7**. If the controller **60** receives the job data and controls the respective units, the image forming apparatus **10** executes an image forming operation. The job data includes image data for allowing each single-color unit **21** to form a toner image G, the size of a medium P used for image formation, the width of the medium P used for image formation (the width of the medium P in a direction orthogonal to the transport direction CD of the medium P), data indicating the number of sheets, etc. The image data also includes data indicating an area coverage (%) for forming the toner image G (or image).

Hereinafter, a determining step S**200**, a determining step S**210**, and a determining step S**220** in the control illustrated in the flowchart in FIG. **7** are described. Then, a normal mode (step S**230**) and a special mode (step S**240**) are described.

Determining Step S200

In the determining step S**200**, the controller **60** determines whether or not the controller **60** causes the single-color unit **21**G to form a toner image G with the toner MT. Then, if the controller **60** determines YES in the determining step S**200**, the controller **60** executes determination in the determining step S**210**. If the controller **60** determines NO in the determining step S**200**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the normal mode (step S**230**).

Determining Step S210

In the determining step S**210**, the controller **60** determines whether or not a ratio R**1** of the image width of the toner image G to be formed with the toner MT is larger than a predetermined ratio R**2** (hereinafter, referred to as reference ratio R**2**). In this case, the image width is the maximum width among widths of the toner image G with the toner MT along the width direction of the medium P. The ratio R**1** of the image width is the ratio of the maximum width among the widths of the toner image G with the toner MT along the width direction of the medium P with respect to the width of the medium P used for actual image formation. The reference ratio R**2** is a ratio predetermined for the width of the medium P used for actual image formation. The predetermined ratio in this exemplary embodiment is, for example, ½ (50%) (see FIG. **8**). In a different point of view, the controller **60** determines whether or not the image width of the toner image G to be formed with the toner MT is larger than a predetermined width (a width obtained by multiplying the width of the medium P used for actual image formation by the reference ratio R**2**). Then, if the controller **60** determines YES in the determining step S**210**, the controller **60** executes determination in the determining step S**220**. If the controller **60** determines NO in the determining step S**210**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the normal mode (step S**230**).

Determining Step S220

In the determining step S**220**, the controller **60** determines whether or not an area coverage of the toner image G to be formed with the toner MT (hereinafter, referred to as area coverage C**1**) is higher than a predetermined area coverage (hereinafter, referred to as reference area coverage C**2**). The area coverage of the toner MT represents the percentage of the number of pixels of the toner image G with the toner MT developed by the developing device **28** with respect to the total number of pixels included per unit area when the exposure dot formed by the exposure device **26** on the photoconductor **22** is one pixel. The reference area coverage C**2** of this exemplary embodiment is, for example, 95% (see FIG. **8**). If the controller **60** determines YES in the determining step S**220**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the special mode (step S**240**). If the controller **60** determines NO in the determining step S**220**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the normal mode (step S**230**).

Supplemental Explanation about Determining Steps S**200**, S**210**, and S**220**

As described above, if the controller **60** determines YES in the determining step S**200**, the controller **60** executes the determining step S**210**. If the controller **60** further determines YES in the determining step S**210**, the controller **60** executes the determining step S**220**. That is, if the controller **60** determines YES in the determining step S**220**, the data of the toner image G with the toner MT from the job data is included in an area A**1** in FIG. **8**. In this exemplary embodiment, if the data of the toner image G with the toner MT from the job data is included in the area A**1** in FIG. **8**, the reason for that the image forming apparatus **10** executes the image forming operation in the special mode is described in description for effects of this exemplary embodiment.

Step S**230** (Normal Mode) and Step S**240** (Special Mode)

The normal mode is a mode in which the controller **60** causes the respective single-color units **21** to form toner images G in accordance with the job data. In contrast, the special mode is a mode in which, if the controller **60** determines YES in the determining step S**220** by following the control in FIG. **7**, the controller **60** corrects (changes) the area coverage C**1** from the job data to a corrected area coverage C**3** lower than the area coverage C**1**, and causes the single-color unit **21**G to form a toner image G with the toner MT. In this exemplary embodiment, the corrected area coverage C**3** is, for example, equivalent to the reference area coverage C**2**.

The above description is for the general configuration of the image forming apparatus **10** of this exemplary embodiment.

Toner

Flat Toner (Toner MT)

As shown in FIG. **4**, a toner particle MTP configuring the toner MT contains a metal pigment MP and a binder BD. The binder BD covers the metal pigment MP. The metal pigment MP is flat or substantially flat. To be specific, the metal pigment MP has a long-axis length L**1**, for example, in a range from 5 μm to 12 μm, and a thickness T**1**, for example, in a range from 0.01 μm to 0.5 μm. In this case, the long-axis length L**1** represents a length of a portion with the largest length of the metal pigment MP when the metal pigment MP is viewed in a direction orthogonal to the thickness direction of the metal pigment MP. The toner particle MTP of this exemplary embodiment has a long-axis length L**2**, for example, in a range from 7 μm to 20 μm, and a thickness T**2**, for example, in a range from 1 μm to 3 μm. In this case, the long-axis length L**2** represents a length of a portion with the largest length of the toner particle MTP when the toner particle MTP is viewed in a direction orthogonal to the thickness direction of the toner particle MTP. As described above, the toner particle MTP of this exemplary embodiment is a toner particle having relationships that (long-axis length L**1**)/(thickness T**1**) of the contained metal pigment MP is, for example, in a range from 10 to 1200, and (long-axis length L**2**)/(thickness T**2**) of the toner particle MTP is, for example, in a range from 2.3 to 20 (the toner MT of this exemplary embodiment being a group of the toner particles MTP having the above-described relationships). As described above, the toner MT of this exemplary embodiment is gold color. The gold color is made by using, for example, aluminum for the metal pigment MP configuring the toner particle MTP, and dispersing, for example, a pigment of yellow (Y) in the binder BD.

Non-flat Toner (Toner NT)

As shown in FIG. **5**, a toner particle NTP configuring the toner NT contains, for example, a resin pigment RP and a binder BD. Also, the toner particle NTP is not flat. To be specific, the toner particle NTP of this exemplary embodiment represents a toner particle having relationships that (long-axis length)/(thickness) of the contained resin pigment RP is, for example, smaller than 10, and (long-axis length)/(thickness) of the toner particle NTP is, for example, smaller than 2.3. Also, the circularity of the toner particle NTP of this exemplary embodiment when the toner particle NTP is projected on a flat plane is, for example, 0.90 or larger. Thus, the toner particle NTP (the toner NT) of this exemplary embodiment is a non-flat toner particle (a toner).

The above description is for the toners MT and NT that are used by the image forming apparatus **10** of this exemplary embodiment.

Supplemental Explanation

Supplemental explanation is given below for the configuration of the image forming apparatus **10** of this exemplary embodiment.

Supplemental Explanation 1

As shown in each of FIGS. **6**A and **6**B, the toner MT is held at the transfer belt TB in a state (a standing state) in which the long axis (the axis in the longitudinal direction) of the toner MT is along a direction substantially orthogonal to the outer periphery of the transfer belt TB while the toner MT moves with the transfer belt TB at a part other than the nip N**1** or N**2**. This may be expectedly because the toner MT is polarized in the direction along the long-axis direction of the toner MT. Also, it may be considered that the toner MT adhering to the transfer belt TB in the standing state falls to the transfer belt TB expectedly because the toner MT is pinched by the photoconductor **22** and the transfer belt TB at the nip N**1** and is pinched by the conductive belt CB of the second transfer portion **70** and the transfer belt TB at the nip N**2**.

Supplemental Explanation 2

As described above, in the image forming apparatus **10** of this exemplary embodiment, when a toner image G is formed by using the single-color unit **21**G, an image using the flat metal pigment MT as a coloring matter is formed. When an image is formed by using the toner MT configured of the toner particle MTP containing the flat metal pigment MP, the image reflects light and hence generates metallic glossiness.

Image Forming Operation of Image Forming Apparatus

An image forming operation of the image forming apparatus **10** of this exemplary embodiment is described with reference to the drawings. In the following description, a basic operation of the image forming apparatus **10** is described first, and an operation executed every different job data received from an external device (not shown) is described next. In this case, the basic operation of the image forming apparatus **10** represents an operation that is executed commonly even if job data is different.

Basic Operation

When the controller **60** receives job data from an external device (not shown), the controller **60** activates the toner image forming unit **20**, the transfer device **30**, and the fixing device **50** which are the respective units other than the controller **60**.

The controller **60** causes the charging devices **24** to respectively electrically charge the photoconductors **22**, causes the exposure devices **26** to respectively expose the photoconductors **22** to light, causes the developing devices **28** to respectively develop toner images G, and causes the first transfer rollers **29** to respectively first transfer the toner images G on the moving (circulating) transfer belt TB at the nips N**1**. Also, at first transfer, the controller **60** causes the power supply PS to apply first transfer voltages respectively to the first transfer rollers **29**. In this way, the controller **60** causes the toner image forming unit **20** to form the respective toner images G on the transfer belt TB.

Also, the controller **60** drives the driving source (not shown) of the second transfer unit **34** (to cause the conductive belt CB to circulate, and to cause the conductive brushes **92**A and **94**A to rotate around their axes) and heats the heating portion **50**A of the fixing device **50**.

Then, controller **60** causes the transport device **40** to transport a medium P to N**2** in synchronization with a timing at which the respective toner images G on the transfer belt TB reach the nip N**2** together with the transfer belt TB. The controller **60** causes the power supply PS to apply a second transfer voltage to the shaft **80**A of the BUR **80**. Consequently, the toner images G on the transfer belt TB are second transferred on the medium P passing through the nip N**2**.

Then, the controller **60** causes the transport device **40** to transport the medium P to the nip N**3** of the fixing device **50**. The controller **60** causes the heating portion **50**A to heat the toner T configuring the toner images G second transferred on the medium P and causes the pressing portion **50**B to press the toner T. Consequently, the toner images G on the medium P is fixed to the medium P. The medium P with the toner images G fixed (the medium P with an image formed) is output to the outside of the image forming apparatus **10** by the transport device **40**, and the image forming operation of the image forming apparatus **10** is ended.

The toner T adhering to the conductive belt CB (the aforementioned fog toner etc.) circulates together with the conductive belt CB, and is removed from the conductive belt CB by the removing unit **90**.

The above description is for the basic operation of the image forming apparatus **10**.

Operation of Each Job Data

Next, an operation executed every different job data received from the external device (not shown) is described with reference to FIG. **7**.

If Job Data for Forming Toner Image G with Toner MT is not Included

In this case, the controller **60** determines NO in the determining step S**200**, and controls the respective units other than the controller **60** in the normal mode according to step S**230**. Image formation on a medium P, which is requested for image formation, is executed by the image forming apparatus **10** and the image forming operation is ended.

If Job Data for Forming Toner Image G with Toner MT is Included

In this case, the controller **60** determines YES under the condition in the determining step S**200**, and makes determination in the determining step S**210**.

In this case, if the controller **60** determines NO in the determining step S**210**, the controller **60** controls the respective units other than the controller **60** in the normal mode according to step S**230**. Image formation on a medium P, which is requested for image formation, is executed by the image forming apparatus **10** and the image forming operation is ended.

If the controller **60** determines YES in the determining step S**210**, the controller **60** executes determination in the determining step S**220**.

If the controller **60** determines NO in the determining step S**220**, the controller **60** controls the respective units other than the controller **60** in the normal mode according to step S**230**. Image formation on a medium P, which is requested for image formation, is executed by the image forming apparatus **10** and the image forming operation is ended.

In contrast, if the controller **60** determines YES in the determining step S**220**, the controller **60** controls the respective units other than the controller **60** in the special mode according to step S**240**. To be specific, the controller **60** corrects the area coverage C**1** from the job data to the corrected area coverage C**3**, and causes the single-color unit **21**G to form a toner image G with the toner MT. Image formation on a medium P, which is requested for image formation, is executed by the image forming apparatus **10** and the image forming operation is ended.

Effect

Then, effects of this exemplary embodiment are described.

First, effects of this exemplary embodiment are described with reference to the drawings. In the following description, when effects of this exemplary embodiment are compared with effects of comparative exemplary embodiments (first to third comparative exemplary embodiments), and when the components used in this exemplary embodiment are used in the comparative exemplary embodiments, the reference signs of the components are used without being changed.

First Effect

For a first effect, the image forming apparatus **10** of this exemplary embodiment is described in comparison with an image forming apparatus (not shown) of a first comparative exemplary embodiment described below.

When the image forming apparatus of the first comparative exemplary embodiment causes the single-color unit **21**G to form a toner image G with the toner MT, the image forming apparatus of the first comparative exemplary embodiment executes an image forming operation in a mode similar to the normal mode of this exemplary embodiment. That is, if data of a toner image G with the toner MT from job data is included in the area A**1** in FIG. **8**, the controller of the image forming apparatus of the first comparative exemplary embodiment causes the single-color unit **21**G to form the toner image G with the toner MT with the area coverage C**1** from the job data. In other words, the controller of the image forming apparatus of the first comparative exemplary embodiment has a similar configuration to that of the image forming apparatus **10** of this exemplary embodiment except that the determining step S**210** or S**220** in the flowchart in FIG. **8** is not provided with regard to the image forming operation of the image forming apparatus **10** according to this exemplary embodiment. The image forming apparatus of the first comparative exemplary embodiment has a similar configuration to that of the image forming apparatus **10** of this exemplary embodiment except the above-described point. Also, the image forming operation of the image forming apparatus of the first comparative exemplary embodiment is similar to that of the image forming apparatus **10** of this exemplary embodiment except that the controller **60** does not execute determination in the determining step S**210** or the determining step S**220** with regard to the image forming operation of the image forming apparatus **10** according to this exemplary embodiment.

In the image forming apparatus of the first comparative exemplary embodiment, the controller drives the driving source (not shown) of the metal shaft **94**B configuring the second transfer unit **34** during a period of the image forming operation similarly to the image forming apparatus **10** of this exemplary embodiment. Accordingly, the metal shaft **94**B rotates around its axis, the conductive roller **72** vibrates in the apparatus depth direction and the apparatus height direction by the rotation of gears (not shown) of the conductive brushes **92**A and **94**A and the metal shafts **92**B and **94**B. The conductive belt CB also vibrates in the apparatus depth direction and the apparatus height direction by the vibration of the conductive roller **72**. Consequently, in the case of the first comparative exemplary embodiment, the toner MT adhering to the transfer belt TB in the standing state falls to the transfer belt TB alternately at the near side or the far side in the apparatus depth direction (one side or the other side in the width direction of the medium P), and is second transferred on the medium P in synchronization with the passing timing. Then, as shown in FIGS. **11**A to **11**C, regarding the toner image G (image) whose toner MT configuring the second transferred toner image G is fixed, the flat metal pigment MP falls to the medium P alternately at the one side or the other side in the width direction of the medium P for a vibration period of the conductive roller **72**. If the data of the toner image G with the toner image MT is included in the area A**1** in FIG. **8**, the posture of the flat metal pigment MP periodically varies in the image.

In this case, it may be expectedly considered that the toner MT more likely slips between the transfer belt TB and the medium P at the nip N**2** as the width of the toner image G to be formed with the toner MT is larger and as the area coverage C**1** of the toner MT is higher. As described above, since the conductive belt CB vibrates in the apparatus depth direction and the apparatus height direction, it may be expectedly considered that the toner MT more likely slips at the nip N**2** and falls in the apparatus depth direction (vibration direction of the conductive belt CB) as the width of the toner image G to be formed with the toner MT is larger and the area coverage C**1** of the toner MT is higher. The inventor of this application found that, if the data of the toner image G with the toner MT is in an area A**2** in FIG. **9**, an image with a small periodical variation in posture of the flat metal pigment MP, or in other words, an image in which arrangement unevenness of the flat metal pigment MP is more likely visually recognized. Therefore, in this exemplary embodiment, the area A**1** in FIG. **9** includes the area A**2** in FIG. **10**.

In the image forming apparatus **10** of this exemplary embodiment, as shown in FIG. **7**, if the controller **60** determines YES in the determining step S**220**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the special mode according to step S**240**. That is, if the data of the toner image G with the toner MT from the job data is included in the area A**1** in FIG. **8**, the controller **60** according to this exemplary embodiment controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the special mode according to step S**240**. To be specific, the controller **60** of this exemplary embodiment corrects the area coverage C**1** from the job data to the corrected area coverage C**3**, and causes the single-color unit **21**G to form a toner image G with the toner MT.

Accordingly, with the image forming apparatus **10** of this exemplary embodiment, if the data of the toner image with the toner MT from the job data is included in the area A**1** in FIG. **8**, an image with a smaller periodical variation in posture of the flat metal pigment MP is formed as compared with the image forming apparatus that executes the image forming operation in the normal mode.

In the image forming apparatus **10** of this exemplary embodiment, as shown in FIG. **7**, if the controller **60** determines NO in any of the determining step S**200**, the determining step S**210**, and the determining step S**220**, the controller **60** controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the normal mode according to step S**230**. That is, if the data of the toner image G with the toner MT from the job data is not included in the area A**1** in FIG. **8**, the controller **60** according to this exemplary embodiment controls the respective units other than the controller **60** so that the image forming apparatus **10** executes the image forming operation in the normal mode according to step S**230**. Hence, if the controller **60** of this exemplary embodiment determines NO in the determining step S**210** or the determining step S**220**, the controller **60** causes the single-color unit **21**G to form the toner image G of the toner MT with the area coverage C**1** from the job data.

As described above, if the controller **60** of this exemplary embodiment determines YES in the determining step S**220**, the controller **60** changes the area coverage C**1** to the corrected area coverage C**3** and executes image formation. Accordingly, the image forming apparatus **10** of this exemplary embodiment forms an image to be actually formed on a medium P with a lower area coverage than the area coverage C**1** from the job data. However, the inventor of this application found that, if an image with the area coverage C**1** of 85% of the toner image G with the toner MT is compared with an image with the area coverage C**1** of 100%, a difference Δ in flop index (F.I.) is 1 or smaller, and the difference Δ is at a level that is hardly visually recognized by a person who has ordinary vision. In particular, if an image with an area coverage of 95%, which is the corrected area coverage C**3** in this exemplary embodiment, is compared with an image with an area coverage of 100%, which is higher than the corrected area coverage C**3**, the difference Δ of F.I. is about 0.4. Therefore, in this exemplary embodiment, the corrected area coverage C**3** is, for example, 95%. F.I. is measured under ASTM E2194. To be specific, a medium P on which a solid-fill image is formed uses OS coated paper (manufactured by Fuji Xerox InterField Co., Ltd., and having a basis weight of 127 [g/m^2] and a smoothness of 4735 [sec] measured under JISP 8119). Then, a solid-fill image is formed with the toner MT on a medium P by using the image forming apparatus **10**. Also, when the image forming operation is executed, the temperature of the heating portion **50**A of the fixing device **50** is 155° C.

Second Effect

For a second effect, the image forming apparatus **10** of this exemplary embodiment is described in comparison with an image forming apparatus **10**A of a second comparative exemplary embodiment described below.

The image forming apparatus **10**A of the second comparative exemplary embodiment differs from the image forming apparatus **10** of this exemplary embodiment (see FIG. **7**) in that the determining step S**210** is not provided. Hence, the controller **60** of the second comparative exemplary embodiment does not determine whether or not the ratio R**1** of the image width of a toner image G to be formed with the toner MT is larger than the reference ratio R**2**. If the area coverage C**1** of the toner image G to be formed with the toner MT is higher than the reference area coverage C**2** regardless of the ratio R**1** of the image width of the toner image G to be formed with the toner MT, the controller **60** of the second comparative exemplary embodiment controls the respective units other than the controller **60** in the special mode. The image forming apparatus **10**A of the second comparative exemplary embodiment has a similar configuration to that of the image forming apparatus **10** of the first exemplary embodiment except the above-described point. Also, the image forming operation of the image forming apparatus **10**A of the second comparative exemplary embodiment is similar to that of the image forming apparatus **10** of this exemplary embodiment except that the controller **60** does not execute determination in the determining step S**210** with regard to the image forming operation of the image forming apparatus **10** according to this exemplary embodiment. It is to be noted that the image forming apparatus **10**A of the second comparative exemplary embodiment pertains to the technical scope of the invention.

If data of a toner image G with the toner MT from job data is included in the area A**1** in FIG. **8**, the image forming apparatus **10**A of the second comparative exemplary embodiment forms an image with a smaller periodical variation in posture of the flat metal pigment MP as compared with the image forming apparatus that executes the image forming operation in the normal mode. However, the image forming apparatus **10**A of the second comparative exemplary embodiment executes the image forming operation in the special mode if the ratio R**1** of the image width of the toner image G with the toner MT from the job data is equal to or smaller than the reference ratio R**2** and if the area coverage C**1** is higher than the reference area coverage C**2**. That is, the image forming apparatus **10**A of the second comparative exemplary embodiment forms an image with the corrected area coverage C**3** lower than the area coverage C**1** even when the area coverage C**1** is higher than the reference area coverage C**2** but the image after fixing does not have a noticeably large periodical variation in posture of the flat metal pigment MP.

In contrast, as shown in FIG. **7**, in the image forming apparatus **10** of this exemplary embodiment, if the ratio R**1** of the image width of the toner image G with the toner MT from the job data is equal to or smaller than the reference ratio R**2** and if the area coverage C**1** is higher than the reference area coverage C**2**, the controller **60** determines YES in the determining steps S**210** and S**220** and executes the image forming operation in the normal mode. Accordingly, if the area coverage C**1** from the job data is higher than the reference area coverage C**2** and the ratio R**1** of the image width of the toner image G with the toner MT is equal to or smaller than the reference ratio R**2**, the image forming apparatus **10** of this exemplary embodiment does not execute the image forming operation in the special mode. That is, the image forming apparatus **10** of this exemplary embodiment forms an image with the area coverage C**1** without correcting the area coverage C**1** to the lower corrected area coverage C**3** if the area coverage C**1** is higher than the reference area coverage C**2** but the image after fixing does not have a noticeably large periodical variation in posture of the flat metal pigment MP.

Hence, with the image forming apparatus **10** of this exemplary embodiment, if an image of data in which the area coverage C**1** is higher than the reference area coverage C**2** and if the ratio R**1** of the image width is equal to or smaller than the reference ratio R**2**, the image may be formed with the area coverage C**1**.

Third Effect

For a third effect, the image forming apparatus **10** of this exemplary embodiment is described in comparison with an image forming apparatus (not shown) of a third comparative exemplary embodiment described below.

In the image forming apparatus of the third comparative exemplary embodiment, the ratio R**1** of the image width is a ratio of the width by which a toner image G is actually formed with respect to the width by which a toner image G is formable on the transfer belt TB (hereinafter, referred to as formable width), and the reference, and the reference ratio R**2** is a ratio of a predetermined width with respect to the formable width (for example, 50%). The controller **60** of the image forming apparatus of the third comparative exemplary embodiment executes the determining step S**210** while the ratio R**1** of the image width and the reference ratio R**2** are used for a ratio with respect to the formable width on the transfer belt TB. The image forming apparatus of the third comparative exemplary embodiment has a similar configuration to that of the image forming apparatus **10** of the first exemplary embodiment except the above-described point. Also, the image forming operation of the image forming apparatus of the third comparative exemplary embodiment is similar to that of the image forming apparatus **10** of this exemplary embodiment except for the above-described point with regard to the image forming operation of the image forming apparatus **10** according to this exemplary embodiment. It is to be noted that the image forming apparatus of the third comparative exemplary embodiment pertains to the technical scope of the invention.

The image forming apparatus of the third comparative exemplary embodiment may not execute the special mode even if data of a toner image G with the toner MT is included in the area A**1** in FIG. **8** but the data is equal to or smaller than the reference ratio R**2** of the third comparative exemplary embodiment. In this case, the image forming apparatus of the third comparative exemplary embodiment may form an image with a large periodical variation in posture of the flat metal pigment MT.

In contrast, the controller **60** of the image forming apparatus **10** of this exemplary embodiment executes the determining step S**210** by using the ratio R**1** of the image width and the reference ratio R**2** for the ratio with respect to the width of the medium P used for actual image formation. Accordingly, the controller **60** of this exemplary embodiment may change the ratio R**1** and the reference ratio R**2** in accordance with the width of the medium P used for actual image formation.

Thus, with the image forming apparatus **10** of this exemplary embodiment, as compared with the image forming apparatus that does not change the predetermined width in accordance with the width of the medium P actually used for image formation, an image with a small periodical variation in posture of the flat metal pigment may be formed in accordance with the width of the medium P to be used.

Supplemental Explanation

A method of measuring whether or not the area coverage C**1** from the job data is corrected to the corrected area coverage C**3** is described.

Preparing Process

In a preparing process, plural pieces of job data of different area coverages C**1** (data of solid-fill images) are prepared, and an image forming apparatus serving as a measurement subject forms an image based on each piece of the job data. At least a single piece of data of the toner MT from the plural pieces of job data is included in the area A**1** in FIG. **8**. Also, at least a single piece of data of the toner MT from the plural pieces of job data is not included in the area A**1** in FIG. **8**. The image forming apparatus forms an image in accordance with each piece of job data, image samples are prepared, and the preparing process is ended.

Determining Process

In a determining process, an image of each image sample is enlarged and observed. To be specific, observation is executed by using a microscope. Then, the area coverage of the image sample is compared with the area coverage C**1** of the job data from the result of observation of each image sample. As the result of comparison, if the area coverage of the image sample is lower than the area coverage C**1** of the job data, it is determined that the area coverage C**1** is corrected. Then, the reference area coverage C**2** is obtained by observing plural image samples of different area coverages C**1** by comparing them with each other and observing them, and it is determined whether or not the image forming apparatus implements the invention. Alternatively, without use of an image sample, a toner image G on a medium P after second transfer but before fixing may be observed.

The invention has been described above in detail based on the specific exemplary embodiment; however, the invention is not limited to the above-described exemplary embodiment and other exemplary embodiment may be employed within the scope of the technical idea of the invention.

For example, in the image forming apparatus **10** of the first exemplary embodiment, the controller **60** determines the determining step S**200**, the determining step S**210**, and the determining step S**220**, and executes the image forming operation (mode) in accordance with the determination. However, the mode executed in accordance with each determination is merely an example, and the image forming apparatus **10** of the first exemplary embodiment may include other mode. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

Also, the toner MT used by the image forming apparatus **10** of the first exemplary embodiment is gold color. However, the toner MT may not be gold color as long as the toner MT is a flat toner containing a flat metal pigment. For example, the toner MT may be silver color. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

Also, as shown in FIG. **1**, in the image forming apparatus **10** of the first exemplary embodiment, the single-color unit **21**G that uses the toner MT is arranged at the most upstream side in the moving direction of the transfer belt TB in the toner image forming unit **20**. However, the single-color unit **21**G may not be arranged at the most upstream side in the moving direction of the transfer belt TB as long as the toner image forming unit **20** includes the single-color unit **21**G.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the second transfer voltage is applied to the BUR **80** and the conductive roller **72** configuring the second transfer portion **70** is grounded. However, the second transfer voltage may be applied to the conductive roller **72** and the BUR **80** may be grounded.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the conductive belt CB is an example of the transfer unit. However, instead of providing the conductive belt CB and the tension roller **74** like the second transfer portion **70**, for example, the nip N2 may be formed by the conductive roller **72** and the transfer belt TB. In this case, the conductive roller **72** serves as an example of the transfer unit. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the removing unit **90** configuring the second transfer unit **34** includes the first removing portion **92** and the second removing portion **94**. However, one of the first removing portion **92** and the second removing portion **94** may be omitted as long as the removing unit **90** includes a rotational body that rotates around its axis. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the removing unit **90** configuring the second transfer unit **34** includes the first removing portion **92** and the second removing portion **94**. However, the second transfer unit **34** may include, for example, a rotational body such as an auger that transports a toner T instead of the first removing portion **92** and the second removing portion **94**. That is, the second transfer unit **34** may not include a rotational body that contacts the transfer unit but may include a rotational body that does not contact the transfer unit. When the rotational body that does not contact the transfer unit rotates, the rotational body vibrates the transfer unit, and the vibration causes the toner MT to fall to a transported medium P alternately at the one side or the other side in the width direction of the medium P.

Also, in the image forming apparatus **10** of the first exemplary embodiment, voltages are applied to the metal shafts **92**B and **94**B of the first removing portion **92** and the second removing portion **94**. However, voltages may be directly applied to the conductive brushes **92**A and **94**A.

Also, in the image forming apparatus **10** of the first exemplary embodiment, an example of the reference ratio R2 is being larger than ½ (50%) and an example of the reference area coverage C2 is 95%. However, these conditions may be other conditions because the conditions are based on the sensory evaluation for evaluating whether or not an image with a large periodical variation in posture of the flat metal pigment MP is formed, that is, whether or not an image whose arrangement unevenness of the flat metal pigment MP is likely visually recognized is formed. For example, the reference ratio R2 may be being larger than ⅔, and the reference area coverage C2 may be 85%. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

Also, the image forming apparatus **10** of the first exemplary embodiment executes the image forming operation in the special mode if the data of the toner image with the toner MT from the job data is included in the area A1 in FIG. **8** according to the determining step S**210** and the determining step S**220**. However, the conditions of the determining step S**210** and the determining step S**220** may be changed so that the image forming operation is executed in the special mode if the data of the toner image with the toner MT from the job data is included in the area A2 in FIG. **9**.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the corrected area coverage C**3** is, for example, an area coverage equivalent to the reference area coverage C**2**. However, the corrected area coverage C**3** may be an area coverage different from the reference area coverage C**2** as long as the corrected area coverage C**3** is lower than the area coverage C**1** from the data. For example, the reference area coverage C**2** may be, for example, 95%, and the corrected area coverage C**3** may be, for example, 90%.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the corrected area coverage C**3** is, for example, an area coverage equivalent to the reference area coverage C**2**, that is, a constant value. However, the corrected area coverage C**3** may not be a constant value as long as the corrected area coverage C**3** is lower than the area coverage C**1** from the data.

For example, the corrected area coverage C**3** may be a function of the area coverage C**1**. To be specific, the function of the area coverage C**1** and the corrected area coverage C**3** may be, for example, as follows:

$$C3(\%)=0.9\times C1(\%).$$

Alternatively, the function of the area coverage C**1** and the corrected area coverage C**3** may be, for example, as follows:

$$C3(\%)=C1(\%)-3(\%).$$

Also, in the image forming apparatus **10** of the first exemplary embodiment, the controller **60** determines the determining step S**210** and the determining step S**220**. Also, in the image forming apparatus **10**A of the second comparative exemplary embodiment, the controller **60** does not determine the determining step S**210** but determines the determining step S**220**. However, like an example of the other exemplary embodiment of the invention (the image forming apparatus **10**B), the controller **60** may control the respective units other than the controller **60** according to a flowchart in FIG. **13**. To be specific, the image forming apparatus **10**B of the other exemplary embodiment, the controller **60** does not determine the determining step S**220**, but determines the determining step S**210**. With the image forming apparatus **10**B of the other exemplary embodiment, if the data of the toner image with the toner MT from the job data is included in the area A**1** in FIG. **8**, an image with a smaller periodical variation in posture of the flat metal pigment MP is formed as compared with the image forming apparatus that executes the image forming operation in the normal mode.

Also, if the controller **60** of the image forming apparatus **10** of the first exemplary embodiment executes the determining step S**210** if the controller **60** determines YES in the determining step S**200**, and the controller **60** executes the determining step S**220** if the controller **60** further determines YES in the determining step S**210**. However, as long as the determining step **S210** and the determining step **S220** are executed after the determining step **S200**, the execution order of the determining step **S210** and the determining step **S220** may be inverted. To be specific, like an example of other exemplary embodiment of the invention (image forming apparatus **10**C), the controller **60** may execute the determining step **S210** after the determining step **S220** like a flowchart in FIG. **14**.

Also, in the image forming apparatus of the third comparative exemplary embodiment included in the technical scope of the invention, the ratio R**1** of the image width and the reference ratio R**2** are ratios with respect to the formable width on the transfer belt TB. However, the formable width is an example of a reference for the ratio R**1** of the image width and the reference ratio R**2**, and the reference of the ratio R**1** of the image width and the reference ratio R**2** may be the width of other member. For example, the reference may be the maximum width of a medium P that may be transported by the image forming apparatus, the width of the transfer belt TB, the width of the conductive roller **72**, the width of the BUR **80**, the width of the photoconductor **22**, or the width of other member.

Also, in the image forming apparatus **10** of the first exemplary embodiment, the ratio R**1** and the reference ratio R**2** are changed in accordance with the width of the medium P actually used for image formation. However, according to an exemplary embodiment of the invention, the width of the medium P used by the image forming apparatus is a constant width, and is applied to, for example, an image forming apparatus of an exemplary embodiment that executes image formation by transporting only a medium P of A**4** size in the same direction. In this case, since the width of the medium P actually used for image formation is constant, the ratio R**1** or the reference ratio R**2** is not changed. The image forming apparatuses **10**A and **10**B of other exemplary embodiments may be configured similarly.

The foregoing description of the exemplary embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. An image forming apparatus, comprising:

a forming unit configured to form a toner image with a substantially flat toner containing a substantially flat metal pigment on a movable body;

a transfer unit configured to form a nip with the movable body and to transfer the toner image onto a medium transported to the nip; and

a controller configured to receive data for allowing the forming unit to form the toner image,

wherein the controller is configured to, in response to determining that the received data indicates that the forming unit is to form the toner image with the substantially flat toner containing the substantially flat metal pigment, then determine whether at least one of a first condition and a second condition is satisfied,

wherein the first condition is whether the received data indicates that an image width of the toner image to be formed with the substantially flat toner containing the substantially flat metal pigment is larger than a predetermined width,

wherein the second condition is whether the received data indicates that an area coverage of the toner image to be formed with the substantially flat toner containing the substantially flat metal pigment is higher than a predetermined area coverage, and

wherein the controller is configured to, in response to determining that at least one of the first condition and the second condition is satisfied, cause the forming unit to form the toner image with the substantially flat toner containing the substantially flat metal pigment with a corrected area coverage lower than the area coverage indicated by the received data.

2. The image forming apparatus according to claim **1**, wherein the controller is configured to, in response to determining that the received data indicates that the forming unit is to form the toner image without the substantially flat toner containing the substantially flat metal pigment, then cause the forming unit to form the toner image with the area coverage indicated by the received data.

3. The image forming apparatus according to claim **1**, wherein the area coverage of the toner image to be formed represents a percentage of a number of pixels of the toner image with the substantially flat toner containing the substantially flat metal pigment developed by a developing device of the forming unit with respect to a total number of pixels included per unit area.

4. An image forming apparatus, comprising:

a forming unit configured to form a toner image with a substantially flat toner containing a substantially flat metal pigment on a movable body;

a transfer unit configured to form a nip with the movable body and to transfer the toner image onto a medium transported to the nip; and

a controller configured to receive data for allowing the forming unit to form the toner image,

wherein the controller is configured to, in response to determining that the received data indicates that the forming unit is to form the toner image with the substantially flat toner containing the substantially flat metal pigment, then determine whether both a first condition and a second condition are satisfied,

wherein the first condition is whether the received data indicates that an image width of the toner image to be formed with the substantially flat toner containing the substantially flat metal pigment is larger than a predetermined width,

wherein the second condition is whether the received data indicates that an area coverage of the toner image to be formed with the substantially flat toner containing the substantially flat metal pigment is higher than a predetermined area coverage, and

wherein the controller is configured to in response to determining that both of the first condition and the second condition are satisfied, cause the forming unit to form the toner image with the substantially flat toner containing the substantially flat metal pigment with a corrected area coverage lower than the area coverage indicated by the received data.

5. The image forming apparatus according to claim **4**, wherein the predetermined width is a width obtained by multiplying a width of the medium by a predetermined ratio.

6. The image forming apparatus according to claim **5**, wherein the controller is configured to cause the forming unit to form the toner image with the area coverage indicated by the received data in response to a ratio of the image width indicated by the received data being equal to or smaller than the predetermined ratio and the area coverage indicated by the received data being equal to or smaller than the predetermined area coverage.

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